DOE/NE-ID-11138
Revision 0
April 2004

U.S. Department of Energy
Idaho Operations Office

# Vicinity Discharges Elimination Work Plan for the HWMA/RCRA Post-Closure Permit for the INTEC Waste Calcining Facility at the INEEL

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DOE/NE-ID-11138
Revision 0
Project No. 23518

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# ABSTRACT

The Hazardous Waste Management Act/Resource Conservation and Recovery Act post-closure permit for the Waste Calcining Facility (WCF) at the Idaho National Engineering and Environmental Laboratory requires the identification and quantification of all steam vent and other deliberate water discharges to the land or subsurface in the vicinity of the WCF. In response, an investigation was undertaken to identify and quantify all deliberate water discharges associated with the operations of the Idaho Nuclear Technology and Engineering Center in the vicinity of the WCF. The investigation identified 13 deliberate discharges and the findings were presented in the *Vicinity Discharges Letter Report – HWMA/RCRA Post-Closure Permit for the WCF at INTEC,* ICP/EXT-03-00102. Additional information obtained after the investigation added one more deliberate discharge for a total of 14.

Under the requirements of the post-closure permit, this Work Plan was created to evaluate each identified discharge and determine if it may influence the WCF monitoring well sampling network. Of the 14 deliberate discharges within the designated boundary as described in this Work Plan, none were determined to have any observable influence on the WCF monitoring well sampling network. However, due to their close proximity to the WCF cap, two steam traps should be eliminated by rerouting discharges to nearby condensate return lines.

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# ACRONYMS

| | |
|---|---|
| D&D | decontamination and dismantlement |
| DMP | Detection Monitoring Program |
| HWMA | Hazardous Waste Management Act |
| IDEQ | Idaho Department of Environmental Quality |
| INEEL | Idaho National Engineering and Environmental Laboratory |
| INTEC | Idaho Nuclear Technology and Engineering Center |
| RCRA | Resource Conservation and Recovery Act |
| STP | Sewage Treatment Plant |
| TFIA | Tank Farm Interim Action |
| WCF | Waste Calcining Facility |

# Vicinity Discharges Elimination Work Plan for the HWMA/RCRA Post-Closure Permit for the INTEC Waste Calcining Facility at the INEEL

## 1. INTRODUCTION

The Waste Calcining Facility (WCF) was closed to a landfill standard under HWMA/RCRA in 1998 and is entombed under a concrete cap. The facility is located within the Idaho Nuclear Technology and Engineering Center (INTEC) at the Idaho National Engineering and Environmental Laboratory (INEEL) (Figure 1-1). The Hazardous Waste Management Act (HWMA)/Resource Conservation and Recovery Act (RCRA) post-closure permit for the WCF requires the identification and quantification of all steam vent and other deliberate water discharges to the land or subsurface in the vicinity of the WCF within 90 days of the effective date of the permit (effective October 16, 2003) (IDEQ 2003). In addition, the permit further requires a work plan be prepared within 180 days of the effective date. The work plan will discuss the elimination of any sources of discharge that may impact the WCF monitoring well network.

To facilitate these requirements within the stated time limits, an investigation was conducted by a Bechtel BWXT Idaho, LLC, subcontractor, MSE Technology Applications, Inc., to identify and quantify all deliberate water discharges associated with the operations of INTEC in the vicinity of the WCF. The investigation included reviews of drawings, discussions with plant personnel, and review of INTEC site documents. The results of this investigation were documented in *Vicinity Discharges Letter Report – HWMA/RCRA Post-Closure Permit for the WCF at INTEC* (ICP 2004), which identified a total of 13 deliberate discharges originating from INTEC systems. Additional information obtained after the investigation added one more deliberate discharge for a total of 14. As a follow-on action to this investigation, this Work Plan has been prepared to evaluate the identified discharges and present a plan to eliminate any discharges that may impact the WCF monitoring well network.

### 1.1 Purpose and Scope

The purpose of this Work Plan is to satisfy the requirements of Permit Condition II.H.2, which states

> The permittee shall submit a work plan to eliminate any sources of discharge that may impact the WCF monitoring well network within 180 days (April 12, 2004) of the effective date of this permit (October 16, 2003). The work plan shall include, but not be limited to:
>
> – A list of the discharge sources to be eliminated:
>
> – A detailed timeline identifying critical path activities for each source to be eliminated; and,
>
> – Abandonment of any injection wells shall be consistent with IDAPA 37.03.09.025, Section 12 as necessary.

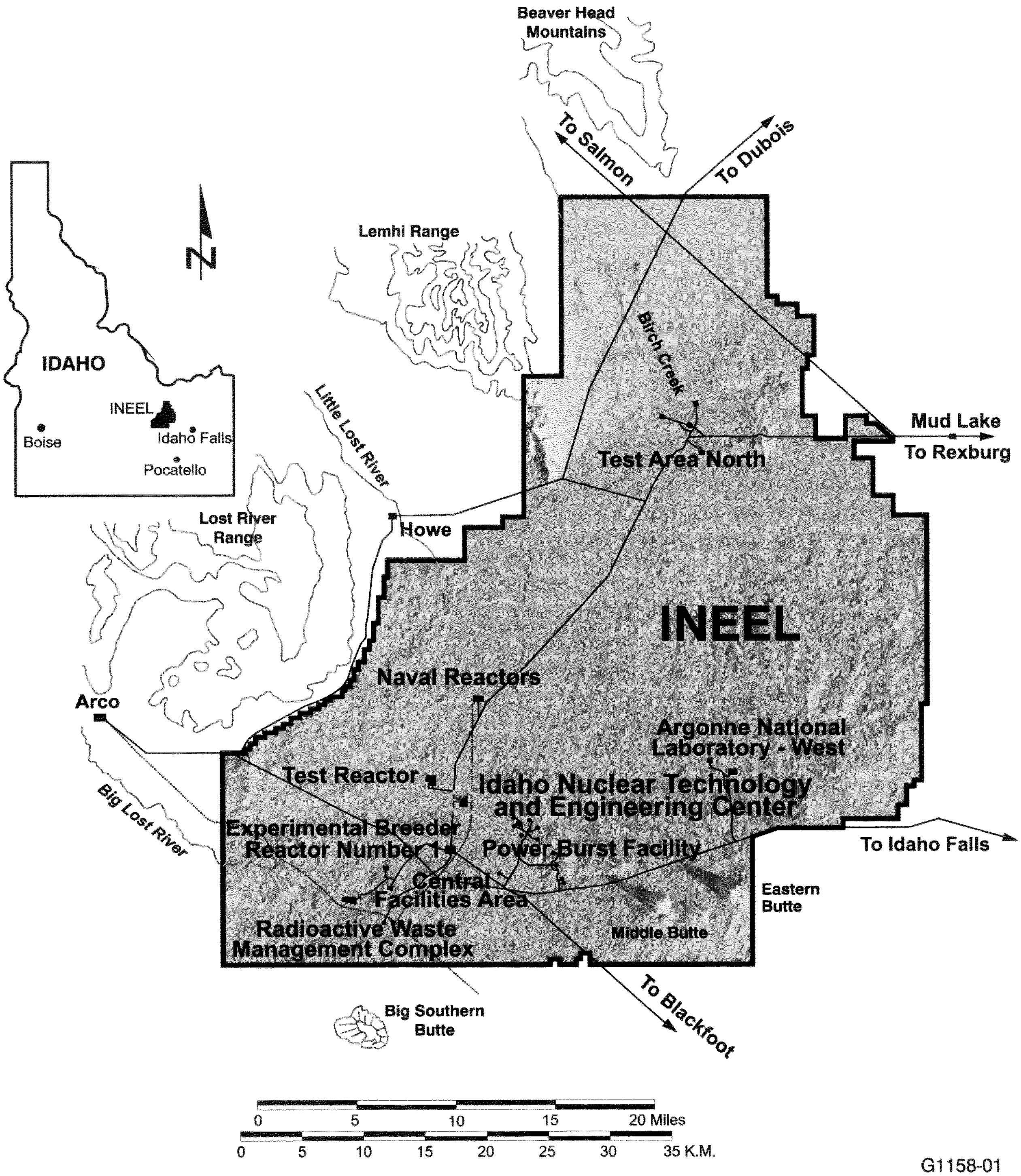


Figure 1-1. Map of the Idaho National Engineering and Environmental Laboratory (INEEL), showing the location of INTEC.

To meet these requirements, the discharges identified in the Vicinity Discharges Letter Report (ICP 2004) along with any additional information obtained since the issuance of the report, were evaluated to determine if they may impact the water quality of the WCF monitoring well network. Idaho's Department of Environmental Quality (DEQ) clarified that they are specifically interested in eliminating any discharges that may impact the five wells that are sampled (see Table 1-1).[a]

This Work Plan includes a timeline listing the steps necessary to eliminate discharges that may influence the sampling wells of the WCF monitoring well network within 540 days (by April 8, 2005) of the effective date of the WCF permit.

## 1.2 Background

Shallow perched groundwater beneath the WCF cap, located within the INTEC facility at the INEEL, is being monitored during the first 2 years from the effective date of the permit to establish background concentrations and will continue to be routinely monitored through a Detection Monitoring Program (DMP) as outlined in the RCRA Post-Closure Permit. The WCF monitoring well network consists of 11 wells in the vicinity of the WCF cap (Figure 1-2). Of these 11 wells, all are monitored for water levels; however, groundwater samples for laboratory analysis are collected from only five of these wells (see Table 1-1) as described in PLN-1373. Located among these wells is a variety of active water systems that are required for normal operations at the INTEC facility (see DOE-ID [2003a]) for detailed information of active water systems). An investigation was recently conducted to determine whether these systems influence the groundwater quality in the sampling well network. A brief description of the WCF, the RCRA Post-Closure Permit, and the investigation that was conducted is presented in the sections below.

### 1.2.1 WCF Facility Description

Stabilization of radioactive liquid waste from fuel reprocessing, through a process known as calcination, was performed at the WCF, located within the INTEC facility at the INEEL. Radioactive liquid waste was converted at the WCF (CPP-633) into a granular solid similar in consistency to sand. The liquid waste was drawn from underground storage tanks at the INTEC tank farm and sprayed into a vessel superheated by a mixture of kerosene and oxygen. Most of the liquid evaporated, while radioactive fission products adhered to the granular bed material in the vessel. The off-gases were treated and monitored before they were released to the environment. The calcined solids were transferred to large stainless steel structures encased in thick concrete vaults (bin sets). The calcining process achieved an eight-to-one volume reduction from liquid to solid. The WCF calciner operated from 1963 through 1981, and the evaporator system operated from 1983 until 1987. In 1982, the WCF calciner was replaced by a similar unit, the New Waste Calcining Facility (DOE-ID 1999).

In 1998, the WCF was closed, under an IDEQ-approved HWMA/RCRA Closure Plan, by knocking down the aboveground portion of the facility to the below-grade structure; grouting and capping the waste lines in place; grouting the tanks, cells, and vaults in place; and constructing a concrete cap over the WCF footprint. The WCF was closed with mixed waste in place and meets the closure requirements applicable to HWMA/RCRA landfills. Further information about the closure can be obtained from INEEL (1997).

---

a. IDEQ, 2004. Permit Handoff Meeting, February 5, 2004.

Table 1-1. WCF monitoring well network (modified from IDEQ 2003).

| Sampling and Water Elevation Wells | | |
|---|---|---|
| Well Name | Well Alias | Well Designation |
| ICPP-MON-P-005 | MW-5 | Point of compliance |
| ICPP-MON-P-013 | MW-12 | Point of compliance |
| ICPP-MON-P-019 | MW-18 | Point of compliance |
| CPP-33-1 | 33-1 | Upgradient background |
| ICPP-MON-P-002 | MW-2 | Upgradient background |
| Water Elevation Wells Only | | |
| Well Name | Well Alias | |
| CPP-33-2 | 33-2 | |
| CPP-33-4 | 33-4 | |
| CPP-37-4 | 37-4 | |
| ICPP-MON-P-004 | MW-4 | |
| CPP-55-06 | 55-06 | |
| ICPP-MON-P-008 | MW-8 | |

### 1.2.2 RCRA Post-Closure Permit

A HWMA/RCRA Post-Closure Permit was issued by IDEQ on September 15, 2003, with an effective date of October 16, 2003. The HWMA/RCRA Post-Closure Permit for the WCF details the requirements for the management and monitoring of the WCF cap. Of particular importance to the permit, are the inspection, maintenance, and sampling of the groundwater monitoring wells identified in the WCF monitoring well network used for sample collection (listed in Table 1-1). The permit requires that deliberate discharges that are in the vicinity of the monitoring well network and that may influence its ability to yield representative groundwater samples be identified and eliminated (for additional information about the HWMA/RCRA Post-Closure Permit for the WCF, refer to IDEQ [2003]).

### 1.2.3 Vicinity Discharges Letter Report

The Vicinity Discharges Letter Report (ICP 2004) was prepared by MSE Technology Applications, Inc., under subcontract to Bechtel BWXT Idaho, LLC. This report summarizes the findings of an investigation that was conducted during October and November of 2003. The investigation identified and quantified all deliberate water discharges associated with the operations of INTEC in the vicinity of the WCF. The investigation included a review of drawings, discussions with plant personnel, INTEC site document reviews, and several site visits.

The Vicinity Discharges Letter Report established the boundary within which the investigation was conducted. The designated boundary perimeter (plotted on Figure 1-2) encloses 67.9 acres and is based upon the area covered by underground utility drawings and in association with the locations of the WCF cap and groundwater monitoring wells in the WCF monitoring network (ICP 2004). Deliberate discharges located outside this boundary and all precipitation-related events were not evaluated. Within this boundary, water distribution systems were evaluated to identify all steam vent and other deliberate

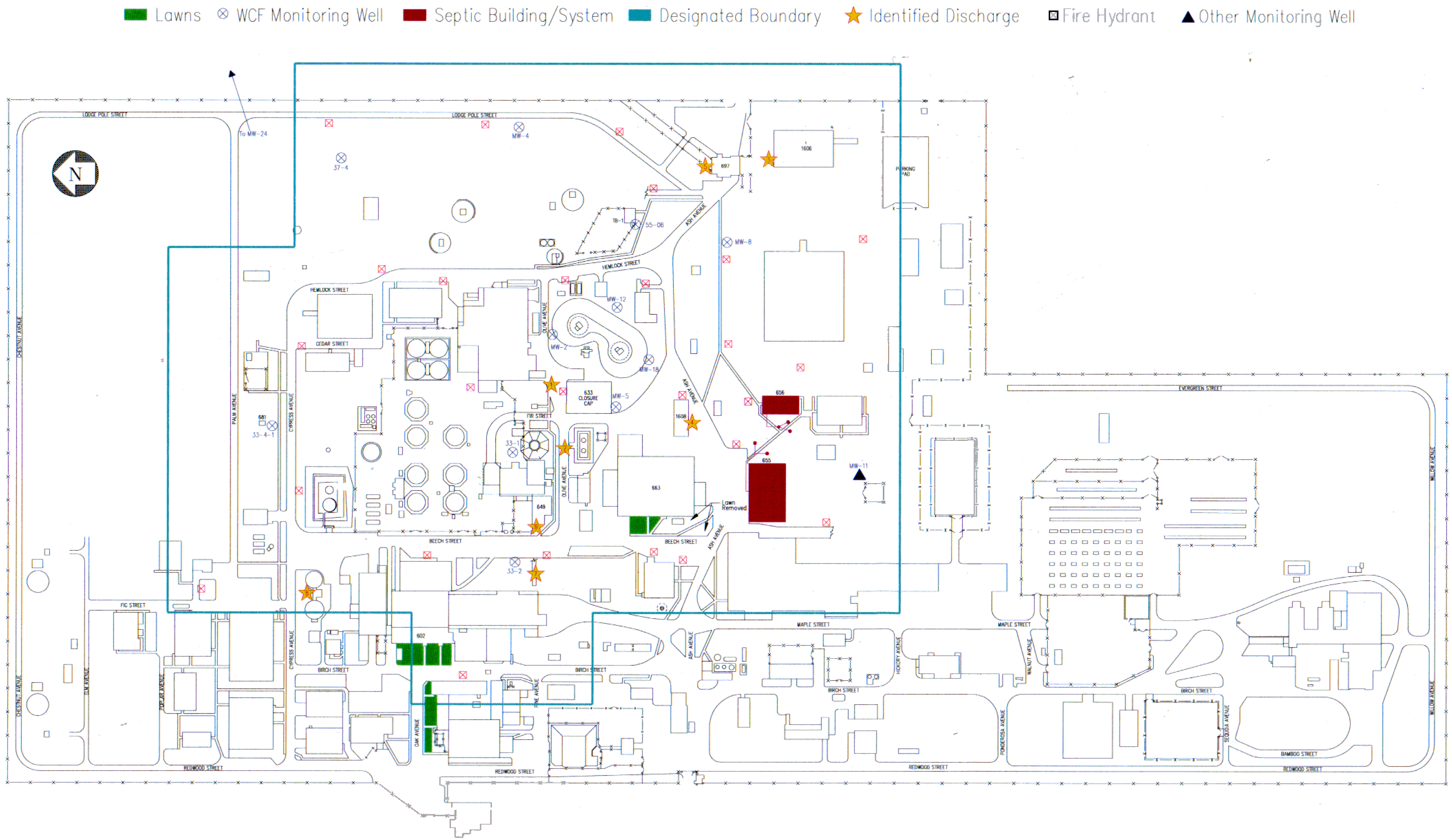

Figure 1-2. Map of INTEC showing designated boundary and location of deliberate discharges (modified from ICP 2004).

water discharges to the ground surface or the subsurface within the general designated boundary. The INTEC facility currently uses approximately 2 million gal of water per day, supplied by two raw waterwells and two potable water wells (DOE-ID 2003a). This water is used for process cooling, equipment cooling, steam production, process solutions, decontaminations, fuel storage basin makeup, chemical laboratory use, regeneration of ion exchange units, fire protection, and human needs such as drinking water, personal showers, food preparation, and restroom facilities. The INTEC systems evaluated include the raw water, fire protection water, potable water, demineralized water, steam/condensate, sanitary sewer, and landscaping water systems (ICP 2004).

A total of 13 deliberate discharges were identified and quantified in the Vicinity Discharges Letter Report that was certified and sent to the IDEQ on January 12, 2004. Additional information obtained after the investigation added one more deliberate discharge for a total of 14. These deliberate discharges, plus additional information obtained after the report was issued, are described in Section 2 of this Work Plan.

# 2. IDENTIFIED DISCHARGES

Discharges identified and quantified in the Vicinity Discharges Letter Report are detailed in Sections 2.1 through 2.5. These sections also include one additional discharge and revised discharge volume estimates, based on additional information that became available following the release of the letter report. This information has been included in the details below. During the investigation and subsequent activities, no deliberate discharges were identified from the treated (softened) water, demineralized water, potable water, or service waste systems. An evaluation of any potential impact of each discharge to the WCF monitoring well network sampling wells and recommended action is in Section 3.

## 2.1 Raw Water System

The raw water backup pump, located in Building CPP-614, is powered by a water-cooled diesel engine. This pump provides backup raw water for the boiler house (CPP-606). The diesel engine is tested once a month for approximately 1 hour and discharges once-through cooling water at the rate of 50 gpm (i.e., 3,000 gal per test) into an unlined storm water drainage ditch located on the north side of CPP-614 (ICP 2004) (Discharge 8 on Figure 1-2).

## 2.2 Firewater System

Fire hydrants within INTEC are tested/flushed yearly in accordance with National Fire Protection Association requirements (DOE-ID 2003a). Testing is conducted in August, a month having a high evaporation rate. This annual activity takes approximately 3 days to complete and the quantity of water expelled to the ground surface during annual flushing is approximately 500 gal per hydrant (ICP 2004). The total quantity of water discharged within the designated boundary during annual fire hydrant flushing is estimated at 13,000 gal per year (from 26 fire hydrants, see Figure 1-2 for locations).

INTEC sprinkler systems (listed as nuclear facilities wet sprinklers) consist of fire suppression systems in designated INTEC buildings that discharge water. A total of 52 discharge testing points were identified, following submittal of the vicinity discharges letter report, from various buildings located within the WCF designated area (see Appendix A). Tests are performed twice a year (spring and fall) at each location, discharging approximately 30 gal per test to the ground for a total of 3,120 gal per year.

## 2.3 Lawn and Landscape Irrigation System

Lawn and landscape areas within INTEC are irrigated between April and October using sprinkling systems controlled by timers. Two of these areas are within the designated boundary and are located adjacent to Buildings CPP-602 and CPP-663 (see Figure 1-2). Water discharged to each area based upon values derived from metering and their square footage is estimated to be 650 gpd for CPP-602 and 400 gpd for CPP-663. Although approximately 15% of the CPP-602 lawn and landscape area is outside the designated boundary, the entire area was used in the discharge estimate (ICP 2004).

The eastern one-third of the lawn and landscape irrigation system adjacent to CPP-637 is located within the designated boundary but was omitted as an identified deliberate discharge in the vicinity discharges letter report. However, CPP-637 is listed on the "Current INTEC DDD Planning" schedule and due to be dismantled by January 31, 2005. This action will eliminate this discharge, making this omission irrelevant. Furthermore, inclusion of the lawn area for CPP-602, which falls outside the designated boundary, makes up for the portion of the CPP-637 lawn area not previously identified in the letter report.

## 2.4 Sanitary Waste System

Buildings CPP-656 and CPP-655 are located within the designated boundary and utilize septic tanks connected to seepage pits to dispose of sanitary waste (see Figure 1-2). Estimated daily discharges are 1,070 and 235 gal, respectively, and are based upon (a) normal human consumption rates of potable water, (b) the assumption that septic loads and potable water usage will be approximately equal, and (c) the assumption that discharge to the septic system should be directly proportional to the number of personnel working in each building (ICP 2004).

## 2.5 Steam and Condensate Return System

Two steam traps (Discharges 1 and 2 on Figure 1-2) were identified during the MSE Technology Applications, Inc. investigation and reported on in the Vicinity Discharges Letter Report. Deliberate Discharges 1 (line number ½" CT-NN-156770) and 2 (line number ½" CT-MM-156757) are both carbon steel condensate lines that originate in the Olive Avenue Utility Tunnel and discharge into separate french drains located just outside the concrete utility tunnel wall. MSE estimated discharge volumes from each steam trap to be 40 gpd (ICP 2004). During a February 12, 2004, visit to each steam trap by INTEC utility operators, photographs were taken (see Figures 2-1, 2-2, and 2-3) and it was observed that Discharge 1 is active (pipe is hot and the steam trap cycled during the visit) yet Discharge 2 is not active (steam trap is valved out and is out of service). Discharge 2 was reportedly valved out in December 2003.

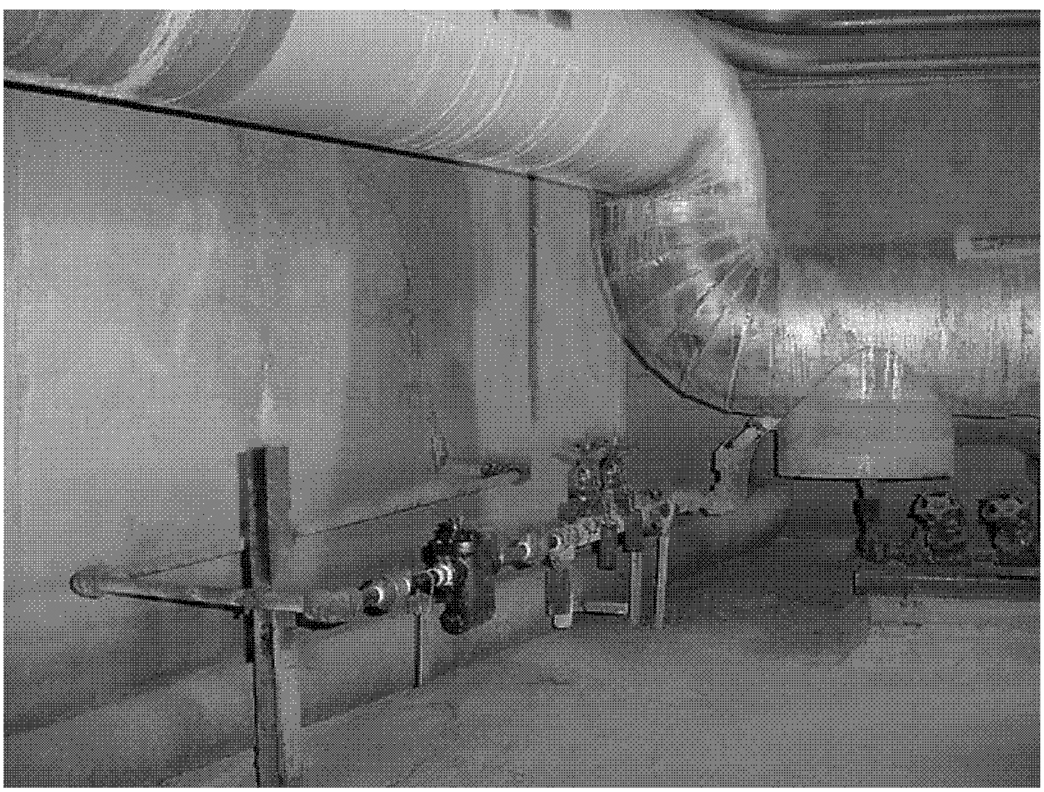

Figure 2-1. Steam trap in utility tunnel (Discharge 1).

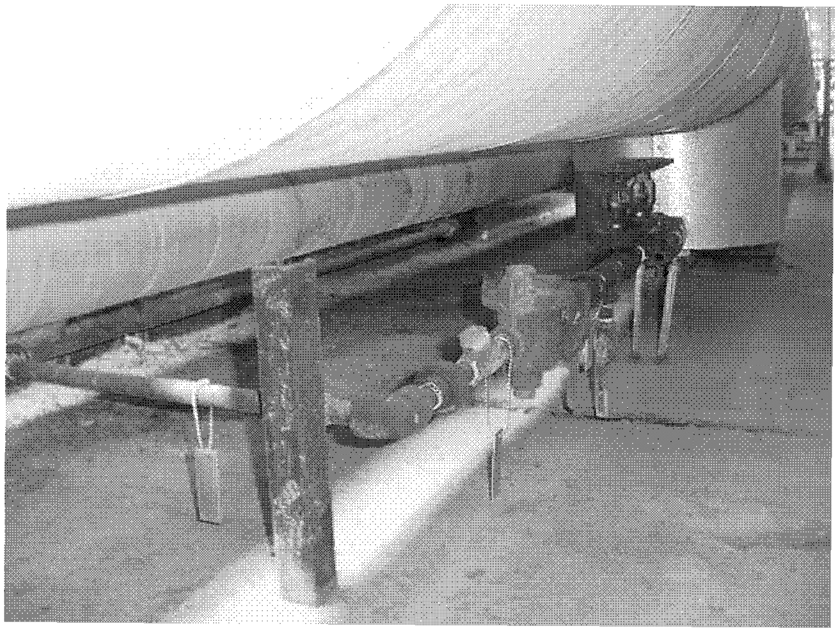

Figure 2-2. Steam trap (Discharge 2) coming from the header.

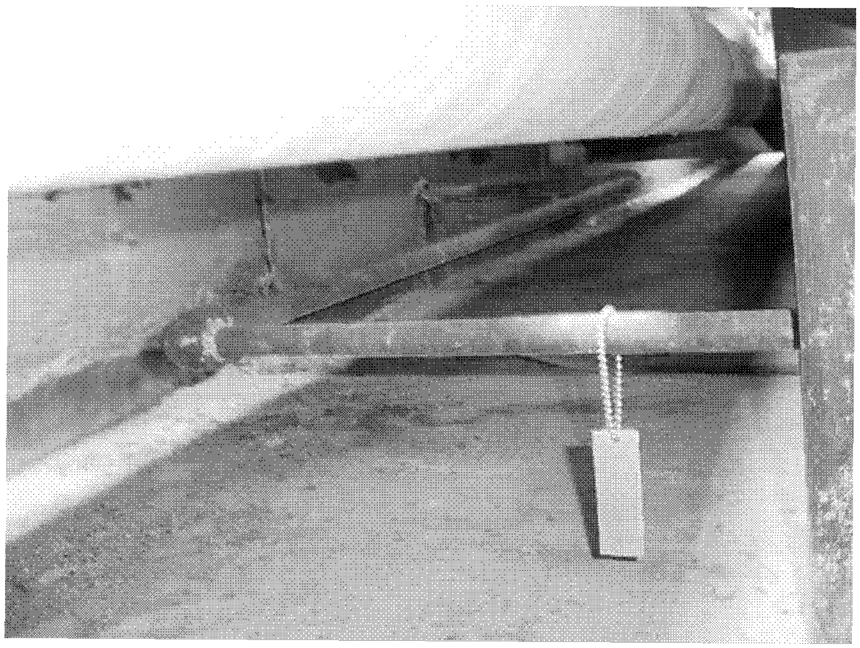

Figure 2-3. Steam trap (Discharge 2) existing out through the utility tunnel wall.

MSE reported in the Vicinity Discharges Letter Report that the heating systems for Buildings CPP-1606, CPP-1608, and CPP-697 discharge steam condensate water to the subsurface (Discharges 3, 4, and 5, respectively, on Figure 1-2). The estimated discharge per building is approximately 365 gpd during the heating season (from September through April). These quantities are based upon building heat loads calculated using the heat load calculator accessible on the Spacepak website (www.spacepak.com).[b] This calculator uses several inputs for estimating a heat load, such as building square footage, ceiling heights, wall lengths, door and window information, insulation information, temperature settings, and other building characteristics. To be conservative, MSE used the highest value from the three buildings for all the buildings and increased the estimate to 365 gal per day per building.

New information obtained since the issuance of the Vicinity Discharges Letter Report has revealed that the heating system for CPP-697 is actually a heat pump and, instead of discharging during the heating season, it, in fact, discharges during the cooling season (May through August) and then mostly during humid days. Volume estimates from facility personnel who have observed this discharge place it at less than 20 gpd.

A review of building characteristics for CPP-1606 and CPP-1608 shows significant differences in square footage (CPP-1606 is 16,130 $ft^2$ and CPP-1608 is 3,000 $ft^2$) with CPP-1606 being over five times larger than CPP-1608. Not considering any other factors, this difference would dramatically reduce the estimated discharge volume for CPP-1608. Since the MSE investigation, it was discovered that only the eastern half of CPP-1608 is actually heated, which would further reduce the heating systems discharge volume. This is now estimated to be approximately 37 gpd (conservatively based upon square footage differences).

The steam line over Beech Street discharges via two steam drip legs identified as Discharges 6 and 7 on Figure 1-2. Discharge 6 is located near the northwest corner of CPP-649 and empties into a shallow injection well made of clay piping encased in asphalt (Figure 2-4). Discharge 7 is located approximately 125 ft west of CPP-649 and is reported to also discharge into a shallow injection well or french drain located below grade (Figure 2-5). The estimated discharge volume from each steam drip leg is 40 gpd. Discharge 6 was physically observed during the fall of 2003 and confirmed to be within ±20 gpd of this estimate. These steam lines are located outside, and output will vary with ambient conditions (ICP 2004).

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b. Brininger, Mike, “Supporting Information for My Assumption on the WCF Post-Closure Letter Report,” M. Shawn Rosenberger, December 8, 2003.

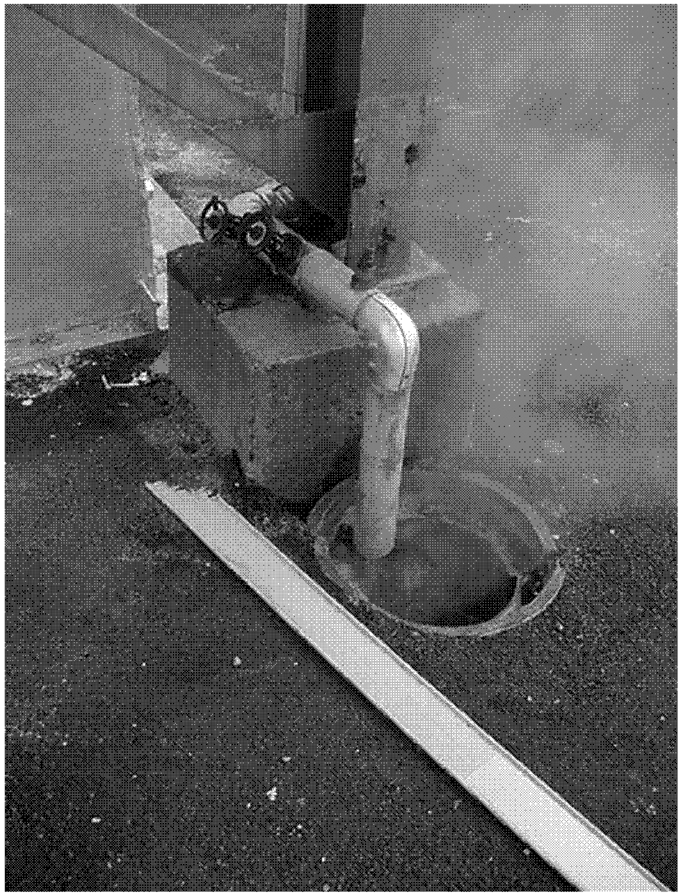

Figure 2-4. Steam drip leg (dated December 22, 2003) (Discharge 6).

Figure 2-5. Steam drip leg (dated December 22, 2003) (Discharge 7).

# 3. EVALUATION AND RECOMMENDED ACTION

A total of 14 deliberate water discharges, described as steam vent, condensate water, septic system, irrigation system, cooling water, and fire hydrant/sprinkler system testing water, have been identified and quantified within the general designated boundary during the MSE Technology Applications, Inc., investigation with subsequent additional information. A summary of these discharges is listed in Table 3-1. The units of measure for estimated volumes have been converted for consistency and comparability.

Table 3-1. Summary of vicinity discharges (modified from ICP 2004).

| Discharge Number[a] | Discharge Description | Estimated Discharge Volume (gpd) | Estimated Discharge Volume (gpy) |
|---|---|---|---|
| 1 | Steam trap connected to steam line number 1/2 in. CT-NN-156770, in Olive Avenue utility tunnel | 40 | 14,600 |
| 2 | Steam trap connected to steam line number 1/2 in. CT-NN-156757, in Olive Avenue utility tunnel | 0 | 0 |
| 3 | CPP-1606 heating system | 365[b] | 88,330 |
| 4 | CPP-1608 heating system | 37[b] | 11,132 |
| 5 | CPP-697 cooling system | 20[c] | 2,460 |
| 6 | Steam drip leg associated with the steam line crossing Beech Street, northwest of CPP-649 | 40 | 14,600 |
| 7 | Steam drip leg associated with the steam line crossing Beech Street, approximately 125 ft west of CPP-649 | 40 | 14,600 |
| 8 | Cooling water from diesel engine in CPP-614 | 99 | 36,000 |
| 9 | CPP-656 septic system | 1,070 | 390,550 |
| 10 | CPP-655 septic system | 235 | 85,775 |
| 11 | CPP-663 lawn and landscape irrigation | 400[d] | 85,200 |
| 12 | CPP-602 lawn and landscape irrigation | 650[d] | 138,450 |
| 13 | Annual fire hydrant testing from 26 locations within the designated boundary | 36 | 13,000 |
| 14 | INTEC sprinkler system testing from 52 locations within the designated boundary | 9 | 3,120 |
| | Totals | 3,050 | 897,817 |

a. Discharges 1 through 8 correspond to numbered "star" symbols on Figure 1-2.

b. Discharge during the heating season from September through April.

c. Discharge during the cooling season from May through August.

d. Discharge during the irrigation season from April through October.

gpd = gallons per day.

gpy = gallons per year.

## 3.1 Evaluation of Discharge Sources

Each identified discharge was qualitatively evaluated to determine which may impact WCF monitoring well network water quality sampling. The criteria used to evaluate each discharge included

- Hydrologic evaluation of deliberate discharges as they might influence the WCF monitoring well network (perched water zones, effective infiltration rates, lithology, etc.)
- Volume of deliberate discharge
- Seasonal discharges (discharges from winter heating/summer cooling and summer irrigation)
- Surface versus subsurface discharges
- Type of surface (ability of water to infiltrate, e.g., pavement versus soil)
- Previous studies (modeling, tracer and infiltration studies)
- Decontamination and dismantlement (D&D) scheduled activities.

The conclusion of this evaluation for each identified deliberate discharge is detailed in Sections 3.1.2 through 3.1.6. Descriptions of discharges that were determined not to impact the WCF monitoring well network and that are not going to be eliminated are provided with justification. Descriptions of discharges to be eliminated contain a recommended course of action.

### 3.1.1 Hydrologic Evaluation of the Area in the Vicinity of the WCF Cap

The water level data collected from the WCF monitoring well network, as reported in the *Annual INTEC Water Monitoring Report for Group 4-Perched Water* (DOE-ID 2003b) were evaluated to determine potential gradients and hydraulic connections within the perched zone monitored by the WCF wells. Table 3-2 summarizes the status of each network monitoring well. As listed, only five of the 11 wells consistently contain water.

Water levels and screened intervals (obtained from well construction diagrams) were evaluated using Surfer©, Version 6.04, surface Mapping System Software. Water levels (where present) were used to create a simple surface plot of the shallow perched water table. Water level elevations and well screen bottom elevations (from dry wells) were plotted and used to evaluate hydraulic gradients of the shallow perched zone beneath the WCF cap (see Figure 3-1). This surface plot is labeled "hypothetical" since it is not likely to be realistic, yet can be used to make several observations. Noted observations from this evaluation were

- Wells 33-4 and 33-2 are located within the same perched zone (are hydraulically connected).
- The horizontal hydraulic gradient between 33-4-1 and 33-2 is 0.00008 ft/ft.
- Wells 37-4 and MW-4 are not hydraulically connected based on an unrealistically high potential gradient (5.08 ft over 480 ft or >0.011 ft/ft).

Table 3-2. Status of WCF monitoring wells (modified from DOE-ID 2003b).

| Well Name | Well Alias[a] | Historical Status |
|---|---|---|
| CPP-33-1 | 33-1[b] | Dry (Feb, May, Oct, Nov, Dec 03, Jan 04) |
| CPP-33-2 | 33-2 | Water (Jan 02 – Jan 04) |
| CPP-33-4-1 | 33-4 | Water (May 03 – Jan 04) |
| CPP-37-4 | 37-4 | Water (Jan 02 – Jan 04) |
| CPP-55-06 | 55-06 | Water (Nov 02 – Jan 04) |
| ICPP-MON-P-002 | MW-2[b] | Water (Nov 02 – Sept 03)<br>Dry (Oct 03)<br>Water (Nov 03 – Jan 04) |
| ICPP-MON-P-004 | MW-4 | Dry (Nov 02 – Jan 04) |
| ICPP-MON-P-005 | MW-5[b] | Water (Nov 02 – Jan 04) |
| ICPP-MON-P-008 | MW-8 | Dry (Nov 02 – Jan 04) |
| ICPP-MON-P-013 | MW-12[b] | Dry (Nov 02 – Jan 04) |
| ICPP-MON-P-019 | MW-18[b] | Dry (Nov 02 – Jan 04) |

a. Refer to Figure 1-2 for well locations.

b. WCF sampling wells.

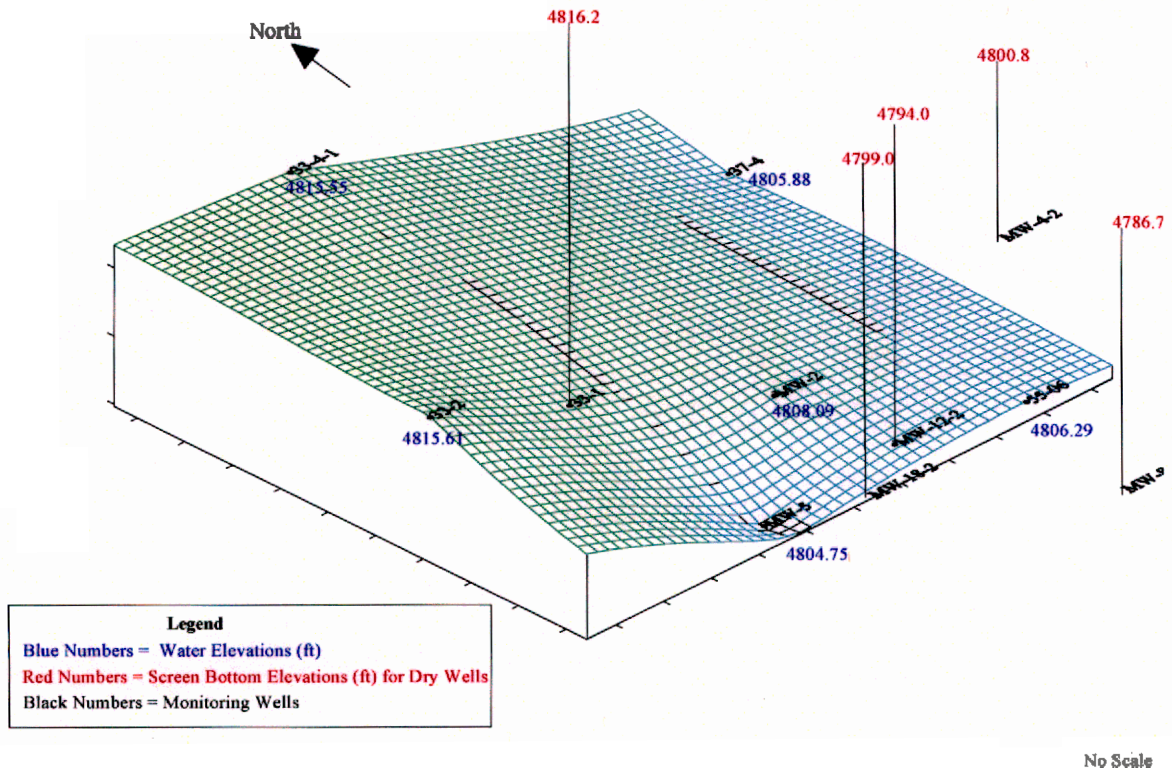


Figure 3-1. Hypothetical surface plot of shallow perched water table (June 10, 2003 data).

- Wells MW-2 and MW-12 are not hydraulically connected based on an unrealistically high potential gradient (14.09 ft over 180 ft or >0.078 ft/ft).

- Wells MW-5 and MW-18 are not hydraulically connected based on an unrealistically high potential gradient (5.75 ft over 130 ft or >0.044 ft/ft).

- Wells 55-06 and MW-8 are not hydraulically connected based on an unrealistically high potential gradient (19.59 ft over 240 ft or >0.082 ft/ft).

- No area-wide gradient could be established for the shallow perched zone.

- Monitoring wells 33-4-1, 33-2, 33-1, 34-4, 55-06, MW-2, and MW-5 are hydraulically isolated from wells MW-4-2, MW-8, MW-12-2, and MW-18-2.

- A hydraulic boundary or barrier (discontinuity) exists between this first and second set of monitoring wells in the bulleted item above and its location is approximated by the red dotted line plotted on Figure 3-2.

Figure 3-2 was created independent of findings or interpretations from previous perched zone studies. Afterward, comparisons of this figure to Figure 2-19 in DOE-ID (1997a) entitled "Approximate extent of the upper basalt perched water bodies at the ICPP" show a nearly identical hydraulic boundary through the midsection of INTEC, confirming the location of the southern boundary of the perched zone beneath the WCF cap.

### 3.1.2 Raw Water System

The cooling water discharge from the monthly testing of the diesel engine in Building CPP-614 is directed into an unlined drainage ditch, on the north side of Building CPP-614, with an estimated length of 50 ft. This ditch slopes eastward toward a culvert that runs beneath Beech Street. The culvert discharges into a lined Tank Farm Interim Action (TFIA) drainage ditch that ultimately transfers the water into the TFIA evaporation pond.

This discharge has been determined to have no impact on the WCF monitoring well network sampling wells based on the following:

- This discharge is the most distant from the five WCF sampling wells than any other identified discharges (unlikely to have any affect on groundwater quality).

- This discharge is a single, once-a-month occurrence with a high flow rate (50 gpm) and short duration. This creates an infrequent, yet high, runoff rate resulting in minimal water infiltration.

- The discharged water travels a very short distance (approximately 50 ft) through an unlined ditch before it enters a culvert (beneath Beech Street) and is captured in the TFIA lined drainage ditch system.

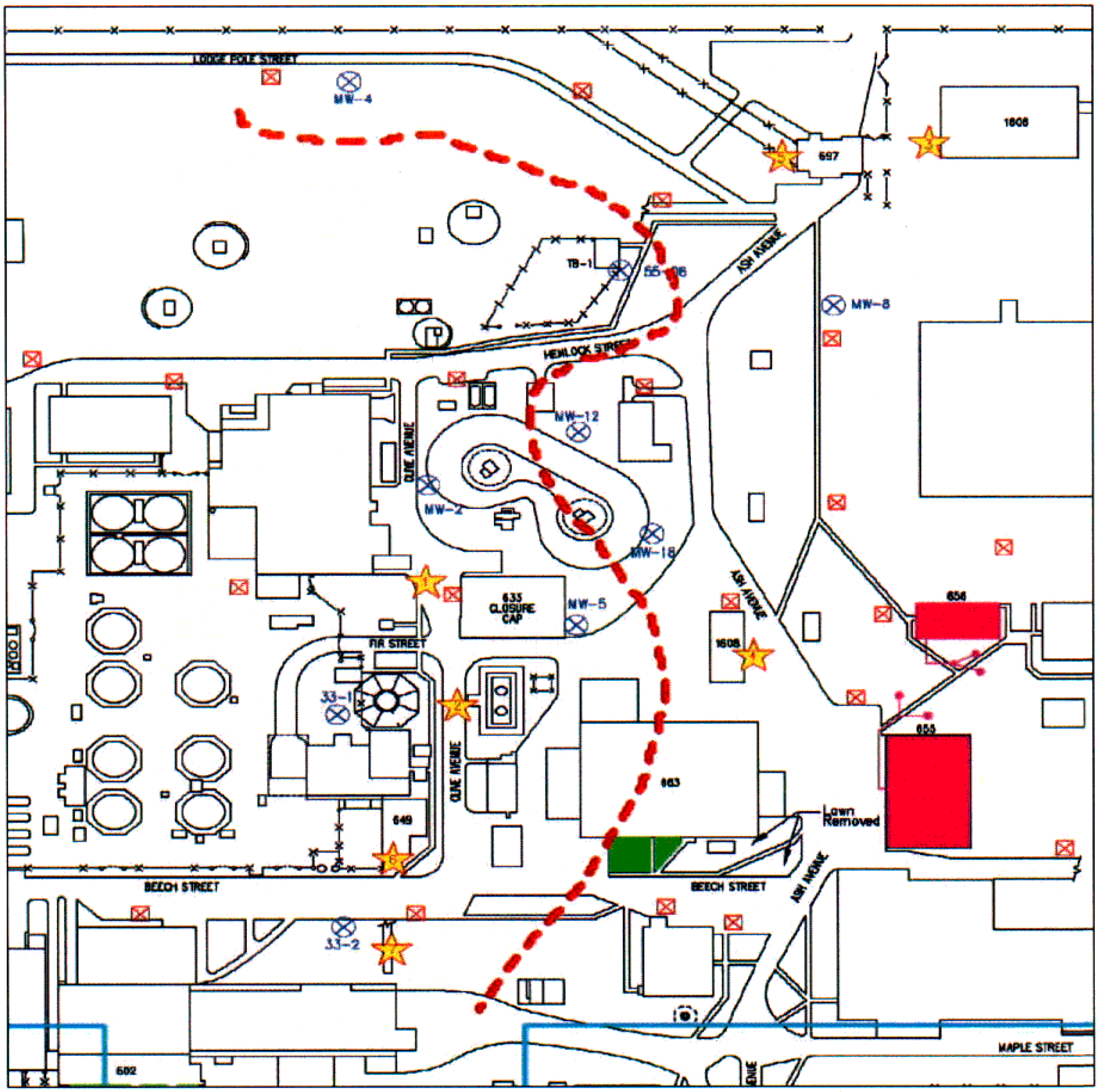


Figure 3-2. Red dotted line approximating the location of the southern boundary of the perched zone beneath the WCF cap (inset map taken from Figure 1-2).

### 3.1.3 Fire Protection System

The annual testing of the fire hydrants within the designated area generates approximately 500 gal of water from each of the 26 hydrants for a total of 13,000 gal. This testing is conducted annually during August. This discharge is considered not to have an impact on the WCF monitoring well network sampling wells for the following reasons:

- Discharges are well dispersed (not concentrated) over most of the designated area (see Figure 1-2).
- Tests are conducted during the hottest time of the year (August), resulting in a very high evaporation rate (low infiltration rate).

- A diffuser is used during each test, forcing the water to spray up into the air in a wide pattern. This minimizes damage to the nearby ground surface, minimizes the concentration of the discharge, and promotes evaporation.

- Observations by testing operators have reported that most discharged water is quickly evaporated, resulting in minimal water infiltration.

- Discharge volumes per fire hydrant are very low over a 1-year period.

The INTEC sprinkler system tests are conducted twice a year (spring and fall) from approximately 52 different locations within the designated area (see Appendix A). Each test lasts 60 seconds and discharges water to the atmosphere from a ¾-in. line at 90 psi (pounds per square inch). Testing operators estimate the discharge per test at 30 gal which has been confirmed using Pipe-Flo® computer software. Total discharge per year from all the tests is approximately 3,120 gal. This discharge is considered not to have an impact on the WCF monitoring well network sampling wells for the following reasons:

- Discharges are well dispersed (not concentrated) over most of the designated area.

- Testing operators perform the tests during warm times of the year, resulting in a higher potential for evaporation (lower infiltration rate).

- The estimated annual discharge volume of 3,120 gal translates to less than 9 gal per day, making this deliberate discharge the smallest by volume.

### 3.1.4 Lawn and Landscape Irrigation System

Lawn and landscape areas adjacent to Buildings CPP-602 and CPP-663 discharge an estimated 650 and 400 gpd respectively between April and October using sprinkling systems controlled by timers. Water discharged to each area is based upon values derived from metering and their square footage (ICP 2004). Table 3-3 compares water requirements to maintain adequate moisture levels versus the estimated water usage based upon metering values. The term "adequate" is defined as the average requirement of 1 in. of water per week. As shown in the table, both lawn and landscape areas initially appear to be receiving more water than required. However, not shown are the additional variables of precipitation, additional moisture requirements of the area's shrubbery and evergreen trees, evapotranspiration, humidity, and temperature. Table 3-4 lists the average monthly precipitation rates plus the mean pan evaporation rates for April through October. As shown in the table, pan evaporation rates are considerably higher than average precipitation. Combined with high temperatures and low humidity levels for INTEC's desert setting, the general conclusion here is that most of, if not all, the water distributed by the irrigation systems is accounted for, allowing for no infiltration. In addition, these lawn and landscape areas are surrounded by impermeable surfaces (buildings, concrete sidewalks, and asphalt roadways) making potential runoff unlikely to infiltrate. No indication can be identified to suggest that the irrigation systems are influencing the WCF well network.

### 3.1.5 Sanitary Waste System

Both Buildings CPP-655 and CPP-656 use septic tanks and seepage pits to dispose of sanitary waste (see Figure 3-3). Based upon a review of the building's characteristics, the current D&D schedule, and the water elevation measurement and geochemical isotope data interpretation, the two identified deliberate septic system discharges appear to be functioning, do not require replacement, and have not been found to have an impact to the WCF monitoring well network. An evaluation of these two systems is presented in Sections 3.1.5.1 and 3.1.5.2 below.

Table 3-3. Lawn and landscape water usage evaluation.

| Building | Estimated Lawn/Landscape Area ($ft^2$) | Water Required Weekly[a] (gal) | Water Required Daily (gal) | Daily Volume Use Estimate[b] (gal) | Daily Excess Water Used (gal) |
|---|---|---|---|---|---|
| CPP-602 | 5,151 | 3,211 | 459 | 650 | 191 |
| CPP-663 | 2,844 | 1,773 | 253 | 400 | 147 |

a. Based on the requirement of 1 in. of water per week (actual amount required will vary due to soil conditions, precipitation, evapotranspiration, etc.)

b. From the Vicinity Discharges Letter Report (ICP 2004)

Table 3-4. Precipitation and pan evaporation rates (inches).

| | Month | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Apr | May | Jun | Jul | Aug | Sept | Oct | Totals |
| Average Precipitation[a] | 0.73 | 1.21 | 1.20 | 0.49 | 0.52 | 0.64 | 0.49 | 5.28 |
| Mean Pan Evaporation[b] | [c] | 7.58 | 9.01 | 10.36 | 9.42 | 6.46 | 3.37 | 46.2[d] |

a. Provided by the National Oceanographic and Atmospheric Administration for the period March 1950 - December 2002 for the Central Facilities Area (INEEL).

b. Mean pan evaporation for the period 1986-1990 from the Aberdeen Experimental Station, Aberdeen, Idaho (Molnau et al. 1992).

c. Data not provided.

d. The National Oceanographic and Atmospheric Administration estimate at the Central Facilities Area is 42 in./year (range from 40 to 45 in.).

#### *3.1.5.1 Life, Operability, and Current Use of the Systems*

No argument could be made for the elimination of the two sanitary system discharges from CPP-655 and CPP-656 due to facility land use characteristics (Table 3-5). Building CPP-655 was activated in 1977 and is currently used as a maintenance shop. The building currently houses 8 personnel and has a planned end use year of 2029. Building CPP-656 was activated in 1978, is used to house 45 office personnel, and has a planned end use year of 2011.

Under well-maintained conditions, septic systems have a normal life span of 20 to 40 years. Based upon the activation years of each building (listed in Table 3-5), it is estimated that the septic systems for Buildings CPP-655 and CPP-656 are approximately 27 and 26 years old, placing them at the mid-point of their life expectancy. No indications have been identified to suggest the two septic systems are not functioning normally and that maintenance or replacements are required. With no reported service problems from these systems, no argument can be made to eliminate them.

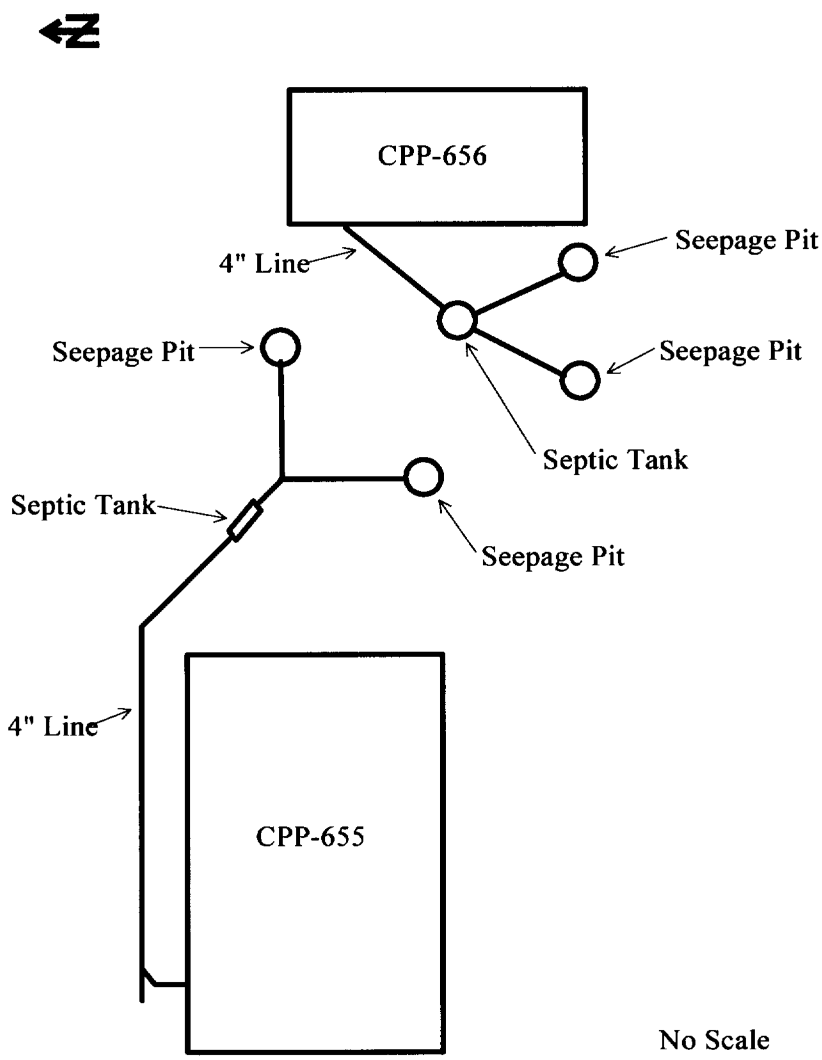


Figure 3-3. Buildings CPP-655 and CPP-656 sanitary systems layout (modified from Drawing #056570).

Table 3-5. Septic tank buildings (DOE-ID 1997b).

| Facility Name | CPP-655 | CPP-656 |
|---|---|---|
| Building use | Parts warehouse with a small section designated as a maintenance shop | Office space |
| Activation year | 1977 | 1978 |
| Utilization and occupancy | 100% | 100% |
| Occupancy (as of 02/04) | 8 personnel | 45 personnel |
| Waste-sanitary size | 4-in. diameter[a] | 4-in. diameter[b] |
| Planned end use year | 2029 | 2011[c] |

a. Line number 4-in. WQN-105547 to Septic Tank VES-CW-100 to Seepage Pits MAH-CW-WQ-315 and 316 (Reference Drawing #056570).

b. Sanitary waste conveyed to Septic Tank VES-CA-101 to Seepage Pits MAH-CW-WQ-317 & 318 (Reference Drawing #056570).

c. Planned end use year may change upon revision of current D&D list.

***3.1.5.2 Hydrologic evaluation.*** These two discharges are located south of the dotted line that approximates the location of the southern boundary of the perched zone beneath the WCF cap (see Figure 3-2) isolating these discharges from three of the five WCF network sampling wells. The two remaining sampling wells south of this boundary line (MW-12 and MW-18) have reportedly been dry from November 2002 through January 2003, indicating that these discharges have no influence on the WCF well network. In addition, monitoring well MW-11 (not part of the WCF network), located approximately 200 ft south-southwest of the two septic systems (see Figure 1-2), was reported to be dry during May, June, and July of 2003 (DOE-ID 2003b), indicating that the shallow perched zone beneath these septic systems is dry and that their deliberate discharges have no influence on the WCF monitoring well network.

A geochemical and stable isotopic study is currently underway to assess recharge sources to the perched water zones. This "geochemical study" is being performed under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Operable Unit 3-13, Group 4, and the various tasks are outlined in the Field Sampling Plan (DOE-ID 2003c). The results of the geochemical study will not be available until September 2004, but some preliminary data have been collected during September and December 2003 (see Appendix B).

One objective of the geochemical study is to assess the potential that wastewater effluent may be impacting the perched water in some locations. Septic system effluent would be similar to the effluent from the INTEC Sewage Treatment Plant (STP) in terms of its chemical and isotopic composition. The preliminary geochemical data show a clear impact from the STP on monitor well MW-24 located close to the sewage treatment lagoons. (Note: MW-24 is not part of the WCF monitoring well network.) In addition, monitor well 37-4, located in the northeast portion of INTEC, also shows a STP impact. Perched water samples from both of these monitor wells show significantly elevated N-15/N-14 isotopic ratios, as expected for wastewater effluent. In addition, water from MW-24 is heavy with respect to stable isotopic ratios of hydrogen (H-2) and oxygen (O-18) compared to other perched monitor wells, but is similar to the STP effluent. In contrast, isotopic results of perched water from MW-5 (closest well containing water to the two operating septic systems) do not indicate any impact from wastewater effluent. Rather, perched water at MW-5 is isotopically similar to that in other perched monitor wells located around the northern portion of INTEC. These preliminary results indicate that the septic systems do not have a measurable impact on the water quality at MW-5, and, hence, do not impact the WCF monitoring well network.

### 3.1.6 Steam and Condensate System

A total of seven deliberate steam and condensate discharges have been identified within the designated boundary. Two are listed as steam traps associated with the utility tunnel beneath Olive Avenue, three are listed as heating system condensate discharges, and the remaining two are listed as steam drip legs associated with the steam line crossing Beech Street near Building CPP-649.

The two steam traps (Discharges 1 and 2 on Figure 1-2) inside the utility tunnel beneath Olive Avenue are both described as 1/2-in. carbon steel lines that originate from a main condensate header, travel through a steam trap, and discharge to separate french drains located just outside the utility tunnel concrete walls. As of December 2003, only one of these discharges (1) is active (at an estimated 40 gpd), and the second (2) is valved out and out of service (malfunctioning steam trap component). INTEC Facility Maintenance does plan to repair Discharge 2, which would then discharge an estimated 40 gpd to the nearby french drain as it had previously done. Although it cannot be shown that these steam traps can impact the WCF monitoring network, because of their close proximity to the WCF cap and the WCF monitoring wells that are sampled and because they discharge to the subsurface, they will be eliminated.

A recommendation is to reroute each discharge line to a nearby condensate return line. Discharge lines exiting the utility tunnel walls are to be cut and capped.

The three heating/cooling system discharges associated with Buildings CPP-1606, CPP-1608, and CPP-697 (Discharges 3, 4, and 5 on Figure 1-2) seasonally discharge reported volumes of 365, 37, and 20 gpd, respectively. These three discharges are located south of the dotted line that approximates the location of the southern boundary of the perched zone beneath the WCF cap (see Figure 3-2), isolating these discharges from three of the five WCF network sampling wells. The two remaining sampling wells south of this boundary line (MW-12 and MW-18) have reportedly been dry from November 2002 through January 2003, indicating that these discharges have no influence on the WCF well network. In addition, the nearby WCF network water elevation well MW-8 has been reported as dry since November 2002, further suggesting no influence is occurring to the WCF sampling wells by these discharges.

The two steam drip legs associated with the steam line crossing Beech Street near Building CPP-649 (Discharges 6 and 7 on Figure 1-2) have an estimated flow of 40 gpd each, for a total cumulative flow of 80 gpd (ICP 2004). Discharge 6 is a surface discharge and susceptible to evaporation, more so than Discharge 7 which is a subsurface discharge. The combined annual flow of steam condensate to the ground surface is approximately 29,000 gal per year. This is equivalent to a maximum of approximately 0.1 acre-foot of steam condensate per year. To put this small discharge in context, the Operable Unit 3-13 modeling assumed a net precipitation infiltration rate of 10 cm/yr (0.33 ft/yr) inside the INTEC security fence. Applying this infiltration rate over the 68-acre area identified in the Vicinity Discharges Letter Report (ICP 2004), approximately 22 acre-feet of precipitation is believed to infiltrate into the subsurface each year at INTEC. Thus it is clear that the 0.1 acre-foot of steam condensate being intentionally discharged to the ground each year from the two steam drip legs represents less than 0.5% of the total precipitation infiltration at INTEC. With respect to water quality, it should be noted that the steam condensate has a similar composition to distilled water. Therefore, based both on the *de minimus* quantity of steam condensate discharged and on the high water quality of this discharge, it is reasonable to conclude that these steam discharges would not have any measurable impact on water levels or water quality in the shallow perched water zones of the WCF monitoring network.

### 3.1.7 Summary of Evaluations with Recommendations

The deliberate discharges listed in Table 3-1 total approximately 898,000 gal per year. This annual discharge volume equates to less than 0.5 in. of water per year over the designated area, or less than 6% of the average annual precipitation rate of 8.7 in. (ICP 2004). Prior to the implementation of the TFIA, it was estimated that net recharge from precipitation is about 1.6 in./yr (DOE-ID 1997a), which is significantly larger than the total volume estimated for the deliberate discharges.

Of the 14 deliberate discharges identified within the designated boundary as described in this work plan, none were determined to have any observable influence on the WCF monitoring well sampling network. However, due to their close proximity to the WCF cap, it is recommended that deliberate Discharges 1 and 2 (see Figure 1-2) should be eliminated by rerouting discharges to nearby condensate return lines. Evaluations and recommendations are summarized in Table 3-6.

Table 3-6. Summary of recommended and alternative actions.

| Discharge Number[a] | Discharge Description | Evaluation Summary and Recommended Action |
|---|---|---|
| 1 | Steam trap connected to steam line number 1/2 in. CT-NN-156770, in Olive Avenue utility tunnel | Discharges are in close proximity to the WCF cap. Redirect discharge to condensate return line. |
| 2 | Steam trap connected to steam line number 1/2 in. CT-NN-156757, in Olive Avenue utility tunnel | |
| 3 | CPP-1606 heating system | Do not influence the WCF well network. No action. |
| 4 | CPP-1608 heating system | |
| 5 | CPP-697 cooling system | |
| 6 | Steam drip leg associated with the steam line crossing Beech Street, northwest of CPP-649 | |
| 7 | Steam drip leg associated with the steam line crossing Beech Street, approximately 125 ft west of CPP-649 | |
| 8 | Cooling water from diesel engine in CPP-614 | |
| 9 | CPP-656 septic system | |
| 10 | CPP-655 septic system | |
| 11 | CPP-663 lawn and landscape irrigation | |
| 12 | CPP-602 lawn and landscape irrigation | |
| 13 | Annual fire hydrant testing from 26 locations within the designated boundary | |
| 14 | INTEC sprinkler system testing from 52 locations within the designated boundary | |

a. Discharges 1 through 8 correspond to numbered “star” symbols on Figure 1-2.

# 4. DETAILED TIMELINE

Table 4-1 lists the enforceable dates as identified in the HWMA/RCRA Permit.

Table 4-1. Schedule of compliance.

| | Enforceable Completion Date |
|---|---|
| Effective date of permit (10/16/03) | |
| Identify and quantify all deliberate water discharges within 90 days of the effective date of the permit | 1/14/04 |
| Submit work plan to DEQ within 180 days of the effective date of the permit | 4/12/04 |
| Implement the approved work plan within 60 days of DEQ approval | TBD |
| Eliminate discharge points within 540 days of the effective date of the permit | 4/08/05 |

As per the requirements of Permit Condition II.H.2 b, Table 4-2 provides a detailed timeline identifying critical path activities for each source to be eliminated.

Table 4-2. Detailed timeline for Work Plan implementation and completion.

| Discharge Number | Discharge Description | Activity | To Be Completed |
|---|---|---|---|
| 1 and 2 | Steam traps associated with Olive Avenue utility tunnel | Prepare engineering design | Month 3[a] |
| | | Prepare work control | Month 5 |
| | | Perform work to eliminate discharges | Month 8 |

a. The first activity shall begin within 60 days of IDEQ approval of this Work Plan, as required by Permit Condition II.H.3.

# 5. REFERENCES


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# Appendix A

# INTEC Sprinkler System Building and Equipment ID Number List

# Appendix A

# INTEC Sprinkler System Building and Equipment ID Number List

Table A-1. INTEC sprinkler system groups.

(Nuclear Facilities Wet Sprinkler)

| Building | Equipment ID # | Inside WCF Designated Area? | Spring Discharge (gal) | Fall Discharge (gal) |
|---|---|---|---|---|
| CPP-637 | FSS-PIF-637 | YES | 30 | 30 |
| | FSS-PIF-637-2 | YES | 30 | 30 |
| | FSS-PIF-637-3 | YES | 30 | 30 |
| CPP-620 | FSS-HBF-620 | YES | 30 | 30 |
| CPP-620 Annex | FSS-HBF-620-1 | NO | | |
| CPP-666 | FSS-FO-666 | YES | 30 | 30 |
| | FSS-FT-666 | YES | 30 | 30 |
| CPP-601 | FSS-PM-601 Access Corridor | YES | 30 | 30 |
| | FSS-PM-601 Operating Corridor | YES | 30 | 30 |
| | FSS-PM-601 PM Area | YES | 30 | 30 |
| | FSS-PM-601-T Cell | YES | 30 | 30 |
| CPP-602 | FSS-LA-602 | YES | 30 | 30 |
| | FSS-LB-602 | YES | 30 | 30 |
| | FSS-LC-602 | YES | 30 | 30 |
| CPP-630 | FSS-SSB-630 | YES | 30 | 30 |
| CPP-659 | FSS-NCM-659 | YES | 30 | 30 |
| | FSS-NCD-659 | YES | 30 | 30 |
| CPP-694 | FSS-NCE-694 | YES | 30 | 30 |
| CPP-684 | FSS-RAL-684 | YES | 30 | 30 |
| CPP-603A | FSS-SF-603 | NO | | |
| CPP - 604/605/649 | FSS-WL-605 | YES | 30 | 30 |
| CPP-666 | FSS-FR-666 | YES | 30 | 30 |
| CPP-1619 | FSS-SAB-1619 | NO | | |

Table A-1. (continued).

(Nuclear Facilities Wet Sprinkler)

| Building | Equipment ID # | Inside WCF Designated Area? | Spring Discharge (gal) | Fall Discharge (gal) |
|---|---|---|---|---|
| CPP-659 | FSS-NCO-659 | YES | 30 | 30 |
| | FSS-NCC-659-1 | YES | 30 | 30 |
| | FSS-NCC-659-2 | YES | 30 | 30 |
| | FSS-NCD-659-1 | YES | 30 | 30 |
| | FSS-NCD-659-2 | YES | 30 | 30 |
| | FSS-NCD-659-3 | YES | 30 | 30 |
| | FSS-NCD-659-4 | YES | 30 | 30 |
| CPP-1631 | FSS-OB6-1631 | NO | | |
| CPP-606/616/644 | FSS-PH-606 | YES | 30 | 30 |
| CPP-614 | FSS-PHE-614 | YES | 30 | 30 |
| CPP-1604 | FSS-OB4-1604 | NO | | |
| CPP-1686 | FSS-YDJ-1686 | NO | | |
| CPP-654 | FSS-NCE-654-1 | YES | 30 | 30 |
| | FSS-NCE-654-2 | YES | 30 | 30 |
| CPP-699 | FSS-NCE-699 | YES | 30 | 30 |
| CPP-662 | FSS-MA-662 | YES | 30 | 30 |
| CPP-1749 | FSS-YDA-1749 | YES | 30 | 30 |
| CPP-1643 | FSS-DW-1643 | NO | | |
| CPP-1605 | FSS-OB5-1605-1 | NO | | |
| CPP-645 | FSS-OB1-645 | NO | | |
| CPP-652 | FSS-MA-652 | NO | | |
| CPP-668 | FSS-OB2-668 | NO | | |
| CPP-660 | FSS-SAA-660 | NO | | |
| CPP-664 | FSS-NCE-664 | YES | 30 | 30 |
| Trailer 35 | FSS-YDK-TR35 | YES | 30 | 30 |
| CPP-663 | FSS-MA-663 | YES | 30 | 30 |
| CPP-1644 | FSS-CS-1644 | NO | | |
| CPP-1642 | FSS-DW-1642 | NO | | |
| CPP-1649 | FSS-IS-1649 | YES | 30 | 30 |
| CPP-1647 | FSS-PHE-1647 | YES | 30 | 30 |
| CPP-1674 | FSS-SA1-1674 | NO | | |

Table A-1. (continued).

(Nuclear Facilities Wet Sprinkler)

| Building | Equipment ID # | Inside WCF Designated Area? | Spring Discharge (gal) | Fall Discharge (gal) |
|---|---|---|---|---|
| CPP-1646 | FSS-SAB-1646 | NO | | |
| CPP-679 | FSS-CA-679 | YES | 30 | 30 |
| CPP-697 | FSS-EG-697 | YES | 30 | 30 |
| CPP-1673 | FSS-PHE-1673 | NO | | |
| CPP-1683 | FSS-WL-1683 | YES | 30 | 30 |
| CPP-1662 | FSS-YDE-1662 | YES | 30 | 30 |
| CPP-1671 | FSS-PFS-1671 | NO | | |
| CPP-698 | FSS-CW2-698 | NO | | |
| CPP-1634 | FSS-TDF-1634 | YES | 30 | 30 |
| CPP-1635 | FSS-SAB-1635 | NO | | |
| CPP-656 | FSS-OB3-656 | YES | 30 | 30 |
| CPP-1650 | FAS-OB8-1650 | NO | | |
| CPP-1682 | FSS-KRS-1682 | YES | 30 | 30 |
| CPP-1651 | FSS-OB9-1651 | NO | | |
| CPP-1663 | FSS-YDE-1663 | YES | 30 | 30 |
| CPP-655 | FSS-CW-655 | YES | 30 | 30 |
| CPP-1666 | FSS-OB10-1666 | NO | | |
| CPP-626 | FSS-SFE-626 | NO | | |
| CPP-609/653 | FSS-VM-653 | NO | | |
| CPP-1606 | FSS-FPE-1606 | YES | 30 | 30 |
| CPP-1608 | FSS-MA-1608 | YES | 30 | 30 |
| CPP-1617 | FSS-SFE-1617 | NO | | |
| CPP-1618 | FSS-WLH-1618 | YES | 30 | 30 |
| CPP-1684 | FSS-WCS-1684 | YES | 30 | 30 |
| | | Total gallons | 1,560 | 1,560 |
| | | Number of tests | 52 | 52 |
| | | Combined total gallons per year | | 3,120 |
| | | Combined total gallons per day | | 8.5 |

# Appendix B

# Preliminary Stable Isotope Results for Shallow Perched Water

# Appendix B

## Preliminary Stable Isotope Results for Shallow Perched Water

Table B-1. Preliminary stable isotope data for water collected during September and December 2003.

| Field ID | Delta H-2[a] | Delta O-18 | Sample Location | Collection Date |
|---|---|---|---|---|
| SWG007013A | -129.56 | -17.01 | MW-10-2 | 9/18/2003 |
| SWG004013A | -128.46 | -16.52 | MW-5 | 9/15/2003 |
| SWG012013A | -131.96 | -17.31 | 33-2 | 9/23/2003 |
| SWG013013A | -129.47 | -16.48 | 33-3 | 9/23/2003 |
| SWG003013A | -128.86 | -16.76 | 55-06 | 9/16/2003 |
| SWG 010013A | -132.35 | -17.22 | MW-1-4 | 9/18/2003 |
| SWG 006013A | -127.6 | -16.64 | MW-20-2 | 9/16/2003 |
| SWG 001013A | -105.61 | -11.04 | Sewage lagoons | 9/11/2003 |
| SWG 014013A | -134.77 | -17.48 | 33-4 | 9/17/2003 |
| SWG008013A | -132.4 | -16.96 | 37-4 | 9/10/2003 |
| SWG009013A | -112.5 | -12.15 | MW-24 | 9/7/2003 |
| SWG000013A | -136.8 | -17.64 | Water supply | 9/10/2003 |
| SWG002013A | -136.8 | -17.67 | Fire/raw | 9/10/2003 |
| SWGO53013A | -132.11 | -17.01 | E. steam cond. | 12/3/2003 |
| SWGO52013A | -135.43 | -17.64 | Fire/raw water | 12/3/2003 |
| SWGO5OO13A | -135.34 | -17.63 | Water supply | 12/3/2003 |
| SWGO51013A | -118.3 | -14.14 | Sewage lagoons | 12/3/2003 |

a. Relative to standard mean ocean water (SMOW) standard.

Table B-2. Preliminary nitrogen and oxygen stable isotope data for nitrate ion.

| Field ID | Delta N-15 of Nitrate[a] | Delta O-18 of Nitrate[b] | Station Name | Collection Date |
|---|---|---|---|---|
| SWG011019A | 5.32 | 7.85 | USGS-50 | 9/10/2003 |
| SWG008019A | 14.07 | -2.8 | 37-4 | 9/10/2003 |
| SWG009019A | 28.99 | -0.78 | MW-24 | 9/09/2003 |
| SWG002019A | 7.32 | -6.05 | Fire/raw | 9/10/2003 |
| SWG010019A | 4.88 | 10.68 | MW-1-4 | 9/18/2003 |
| SWG003019A | 8.21 | 2.76 | 55-06 | 9/16/2003 |
| SWG004019A | 6.77 | -0.23 | MW-5 | 9/15/2003 |

a. Relative to atmospheric nitrogen.

b. Relative to standard mean ocean water (SMOW) standard.